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Redescription of *Tetramorium hungaricum* RÖSZLER, 1935, a related species of *T. caespitum* (LINNAEUS, 1758) (Hymenoptera: Formicidae)

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Abstract

A lectotype is designated and a redescription made for *Tetramorium hungaricum* RÖSZLER, 1935, a Central European taxon. It is shown that this species can be reliably separated from three related morphospecies, i.e., *T. caespitum* (LINNAEUS, 1758), *T. ferox* RUZSKY, 1903, *T. semilaeve* ANDRÉ, 1881, using morphological characters. Diagnostic characters, both morphological and morphometric, are given for the four species.

Key words: *Tetramorium hungaricum*, redescription, morphometrical analysis, taxonomy

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Introduction

Ants are hardly the largest European insect group on the basis of the number of known species. So, given the high number of European myrmecologists, one would presume that there are not many new species left to discover in Europe. However, since the end of the 1980s, a considerable number of species have been described (or revived) often in genera which previously were considered to be well known: e.g., *Lasius* (see SEIFERT 1988, 1992, SCHLICK-STEINER & al. 2003) or *Myrmica* (see SEIFERT 1993, ELMES & al. 2002, RADCHENKO & ELMES 2003). Thus a large proportion of the recent "new" European species is the result of reconsideration of "old" taxa or names, e.g., *Stenamma debile* (FÖRSTER, 1850), *Myrmica lonae* FINZI, 1926, or redescriptions of poorly described species such as *Ponera testacea* EMERY, 1895 (CSŐSZ & SEIFERT 2003).

The genus *Tetramorium* is considered to be one of the most difficult groups within the family Formicidae. It consists of more than 400 species worldwide and over 50 in the Palaearctic Region (BOLTON 1995). Prior to the 1940s, several *Tetramorium* forms had been described, but SOMFAI (1959) and GALLÉ & al. (1998) listed only a few species from the Carpathian basin treating the great majority of taxa as junior synonyms of *T. caespitum*. Subsequently, new view was established and some of the "old" taxa were revived and some new species were described (AGOSTI & COLLINGWOOD 1987, SCHULZ 1996, SEIFERT 1996, RADCHENKO & al. 1998). Further refinements are expected on the basis of molecular and morphological studies (SCHLICK-STEINER & STEINER, pers. comm.).

Recently several nest series were collected in the Carpathian Basin, which did not match the features of *T. caespitum*, or any other currently accepted species. They did, however, appear to match the previously forgotten type material of *T. caespitum* ssp. *hungarica* RÖSZLER, 1935, deposited in the collection of the Natural History Museum, Sibiu (Romania). Although this species was described in 1935 and later elevated to species level (RÖSZLER 1951), it was probably ignored post-1950s because of the lack of information on the contents of the collection of the Natural History Museum of Sibiu (Romania). We have designated a lectotype of *Tetramorium hungaricum* from the Sibiu material and we redescribe this here because the superficial description given by Paul Röszler is inadequate to distinguish it from related species. Its relatives are *T. caespitum, T. ferox*, and *T. semilaeve*; the first two occur in and the third one near to the Carpathian Basin. We show that *T. hungaricum* can be separated from these three species using morphometrics. As *T. caespitum* seems to contain several cryptic species (SCHLICK-STEINER & STEINER, pers. comm.), we treated it as a morphospecies and only the morphologically closest populations to *T. hungaricum* were included in this analysis.

Material and Methods

Measurements

All measurements were carried out on dry mounted specimens. An Olympus SZX 9 stereomicroscope was used at a maximum magnification of × 100. The

accuracy of the measurements is ± 2 μm. All measurements were recorded in μm.

Acronyms

Acronyms and definitions of morphometric characters in worker caste are as follows.

FI	HW / FR
FR	minimum distance between frontal carinae
HI	HL / HW
HL	head length; maximum median length of head capsule in full-face view. The head must be carefully tilted until the maximum length is positioned in measuring plane.
HS	head size; the arithmetic mean of HL and HW
HW	maximum head width in full-face view including eyes
ML	diagonal length of the mesosoma in profile, measured in lateral view from the anteriormost point of pronotal slope to the posteriormost point of the lateral metapleural lobe
MW	maximum mesosomal width in dorsal view
PPI	PPw / HW
PPw	maximum width of postpetiole in dorsal view
Pw	maximum width of petiole in dorsal view
SL	maximum straight-line scape length excluding articular condyle
SPI	SSP / SPL
SPL	minimal distance between center of propodeal spiracle and posterior margin of propodeum
SSP	length of propodeal tooth measured from the center of propodeal spiracle to the tip of spine

Statistical analyses

The morphometrical separation of the four species was carried out on workers by discriminant analysis (PODANI 1993). In the cases of *T. hungaricum – T. semilaeve*, and *T. hungaricum – T. caespitum* species pairs, separate pairwise discriminant analyses were also performed. Seven *T. hungaricum* populations represented by more than three individuals (see the list below) were also analyzed for the interpopulational variability of the morphometrical characters. In all cases spherized scores were used for objects, and the data were first normalized by $\log_{10}$-transformation, then tested for the homogeneity of variances. This latter criterion was fulfilled only in the case of *T. hungaricum* populations, and *T. hungaricum – T. semilaeve* pairwise comparison, thus significances could be attributed only to these results. Between species comparisons of the morphometrical indexes were also carried out by T-test for independent samples in the case of *T. hungaricum – T. semilaeve* and *T. hungaricum – T. caespitum* species pairs. One-way ANOVA was used for the statistical comparison of *T. hungaricum* populations. The data were previously tested for normality and for the homogeneity of the variances.

Workers of the following *Tetramorium* populations were used in the morphometrical analysis (in parentheses the number of examined specimens):

T. hungaricum: Hungary: Nagytétény (35), Pilisszentiván (18), Solymár (4), Sas–hegy (15), Csákvár (12), Csiki-hegyek (1), Paks (4); Austria: Tennauriegel (4).

T. semilaeve: Spain: Montenegre (5); France: Banyuls-sur-Mer. population no. 1 (5), Banyuls-sur-Mer population no. 2 (6); Croatia: Zinj (7); Greece: Kyklades (3); Turkey: Antalya (2).

T. caespitum: Hungary: Sóshartyán (5), Gyula (3), Hortobágy (2), Simontornya (3), Nádudvar (1), Budapest (8), Szöd (4), Újszász (7), Bátorliget (7), Gizellafalva (1); Romania: Deva (2), Săcele (4), Miercurea Ciuc (7), Târnăveni (4); Slovakia: Gömörvég (7), Vepor (3), Muraň (24).

T. ferox: Hungary: Sóshartyán (11), Szigetszentmihály (11); Ukraine: Crimea (3).

Depositories

HNHM	Hungarian Natural History Museum, Budapest, Hungary
IZK	Institute of Zoology of Ukrainian National Academy of Sciences, Kiev, Ukraine
MHNG	Muséum d'Histoire Naturelle, Genéve, Switzerland
NMW	Naturhistorisches Museum, Wien, Austria
NVH	Collection of the Naturwissenschaftlicher Verein zu Hermannstadt at the Natural History Museum of Sibiu, Romania

Material examined

Tetramorium hungaricum:

Austria: Burgenland: NSG Tennauriegel SW Breitenbrunn, 27.VI.2002, leg. Schödl (HNHM); 7229-AUT: Hackelsberg vic. Winden am See (16°46'E / 47° 57' N), 16.VI.2000, leg. B.C. Schlick-Steiner & F.M. Steiner (HNHM); 7232-AUT: same data (HNHM); 10398-AUT: same data except 23.VI.2002, leg. B.C. Schlick-Steiner & F.M. Steiner (HNHM); 10399 AUT: same data (HNHM);10352-AUT: Lower Austria: Spitzerberg vic. Prellenkirchen (16°57'E / 48° 05'N), 23.VI. 2002, leg. B.C. Schlick-Steiner & F.M. Steiner (HNHM); 10368-AUT: Pfaffenberg vic. Bad-Deutsch-Altenburg (16° 55'E / 48°07'N), 23.VI.2002, leg. B.C. Schlick-Steiner & F.M. Steiner (HNHM).

Bulgaria: Sandanski, 23.VI.1956, leg. Bielawski & A. Goljan (IZK).

Hungary: Hongrie, Nagytétény, No. 465, 24.VII. 1934, leg. Röszler (lectotype, NVH, and 13 paralectotypes, HNHM and NMW); Nagytétény, 1.VIII.1934, leg. Röszler (NVH); Nagytétény, 05.VIII.1934, leg. Röszler (NVH); Nagytétény, No. 503, 1.VIII.1934, leg. Röszler (*T. caespitum hungarica* var. *szaboi*, syntype series, NVH); Nagytétény, No. 44, 1.VII.1935, leg. Röszler (*Tetramorium caespitum* ssp. *pyrenae-*

ica var. *biroi*, syntype series, NVH); Nagytétény, No. 499, 19.V.1935, leg. Röszler (*Tetramorium caespitum* ssp. *hungarica* var. *rufitarsis*, syntype series, NVH); Nagytétény, 27.VI.1935, leg. Röszler (NVH); Nagytétény, No. 503, 1.VIII.1934, leg. Röszler (*Tetramorium caespitum* ssp. *hungarica* var. *szaboi*, syntype series, NVH); Nagytétény, No. 16, 29.VI. 1935, leg. Röszler (det as *Tetramorium caespitum* ssp. *hungarica var. rufitarsis-szaboi* [nomen nudum] (NVH); Nagytétény, 5.VIII.1934, leg. Röszler (NVH); Nagytétény, No. 423, 27.VI.1935, leg. Röszler (*T. caespitum* r. *hungarica* var. *rufitarsis* det. Röszler (NVH); Csiki-hegyek, 20.IV.1997, leg. Tartally (HNHM); Pilisszentiván, Kisszénás-hegy, 21.IX. 2001, leg. Tartally (HNHM); Solymár, 30.III. 2002, leg. Tartally (HNHM); Budapest, Sas-hegy, 12.X.2001, leg. Tartally (HNHM); Csákvár, 8.VI. 2001, leg. Tartally (HNHM); Paks, 18.VI.2003, leg. Csősz (HNHM).

Ukraine: Zaporozh'e, Isl. Khortitsa, No. 271, 1.VII. 1982, leg. Radchenko (IZK); Zaporozh'e Reg., near Melitopol, Kamennaya Mogila, No. 190, 12.VI. 1983, leg. Radchenko (IZK); Donetsk Reg., Telmanovsky distr., vil. Granitnoe, No. HY-161, leg. Radchenko (IZK); same data, No. HY-162 (IZK); Donetsk Reg., Nat. Res., Khomutovskaya Step', No. 246, 17.VI. 1983, leg. Radchenko (IZK); Nikolaev Reg., Pervomaysky distr., vil. Migiya, No. 251, 18.VI.1983, leg. Radchenko (IZK); Donetsk Reg., riv. Severskiy Donets, vil. Bogorodichnoe, No. 2139, 7.VII.1982, leg. Radchenko (IZK); Crimea, vicinity of Sympheropol, No. 334-85, 17.VI.1985, leg. Radchenko (IZK); Kherson Reg., near Skadovsk, No. 1968, 30.VI.1970, leg. Teresnikova (IZK); Kherson Reg., Black See Res., vil. Rybal'che, No. 2193, 30.VI.1970, leg. Teresnikova (IZK); Lugansk Reg., Sverdlovsky distr., Nat. Res., Proval'skaya step, No. 1577, 27.VI.1963, leg. Teresnikova (IZK).

Tetramorium caespitum:

Austria: Lower Austria, Hainburg, leg. Breit (NVH).

Hungary: Sóshartyán, 12.V.2002, leg. Csősz (HNHM); Pécs, 28.VIII.1929, leg. Szabó-Patay (HNHM); Tokaj, leg. Anonymus (HNHM); Buda, 2.VIII.1885, leg. Gellért (HNHM); Gyula, 2.VI. 1997, leg. Csősz (HNHM); Hortobágy, 31.VI.1911, leg. Anonymus (HNHM); Simontornya, 16.VIII. 1912, leg. Pillich (HNHM); same data, 28.V.1912 (HNHM); same data, 22.III.191 (HNHM); Gizellafalva, 28.VIII. 1918, leg. Csiki (HNHM); Nádudvar, 25.V.1918, leg. Csiki (HNHM); Budapest, 5.V.1918, leg. Szabó-Patay (HNHM); Szöd, 30.IV.1918, leg. Bíró (HNHM); Újszász, 5.VII.1915, leg. Horváth (HNHM) Bátorliget, 11.VI.1990, leg. Loksa (HNHM).

Romania: Déva [Deva], 10.IV.1912, leg. Győrffy (HNHM); Landskrone [Dealul Cetății, Tălmaciu], 11.IV.1920, leg. Anonymus (NVH); Rákoser Töpe [Braşov], 14.IX.1918, leg. Anonymus (NVH); Serbudatal [Valea Şerbotei, Făgăraş Mts.], 25.IX.1920, leg. Anonymus (NVH); Arbegen [Agârbiciu], X. 1918, leg. Anonymus (NVH); Schlamganzel, Schwarzes Meer [coast of the Black Sea], 4.VIII.1936, leg. Müller (NVH); Hamersdorf [Guşterița – Sibiu], 3.X.1920, leg. Anonymus (NVH); same data except 19.IX.1920 (NVH); S. Regen [Reghin], 30.VIII.1920, leg. Anonymus (NVH); Resinar [Răşinari], 6.1917, leg. Anonymus/NVH; Riu sadului [Valea Sadului], 6.VIII.1925, leg. Anonymus (NVH); Domogled [Domogled Mts., Băile Herculane], 26.VIII.1925, leg. A. Despalalj (NVH); Hohe Rinne [Păltiniş], 9.VI. 1932, leg. Müller (NVH); Dicsőszentmárton [Târnăveni], leg. Csiki (HNHM); Hétfalu, Tatrang-oldal [Săcele], 1.VII.2002, leg. Csősz (HNHM); Csíkszereda, Nagysomlyó, 700m alt., Miercurea Ciuc, 2.VII. 2002, leg. Csősz (HNHM).

Slovakia: Murány [Muraň], 1.IX.1915, leg. Szabó (HNHM); Vepor, 1.VIII.1918, leg. Szabó & Patay (HNHM); Gömörvég, 18.IX.1913, leg. Szabó (HNHM); Ajnácskő [Hajnáčka], 8.VI.1909, leg. Szabó (HNHM).

Tetramorium semilaeve:

Bulgaria: Varna, VI.1956, leg. Balogh (HNHM).

Croatia: Zengg [Senj], 14.VI.1905, leg. Bíró (HNHM).

France: Banyuls, Pyrénées Or., VI.1976, leg Poldi (MHNG); Banyuls-sur-Mer, Pyr. Orient., 28.V.1982, leg. Espadaler (HNHM).

Greece: Kykladen, Paros, Sammelstelle, 10.IV. 1994, leg. Glück & Steinmetz (MHNG).

Italy: Sicily, Palermo, Bagheria, 18.VI.1978, leg. Szabó J.B. (HNHM).

Morocco: MA–002, Rif, 4 km W. Chefchaouen, ca. 500 mH, 24.IV.1995, leg. Güsten, Sanetra & Schumann (MHNG); MA–013, Haut Atlas, Gorges du Todra 15 Rkm N.Tinerhir, ca. 1500 mH, 29-30.IV. 1995, leg. Güsten, Sanetra, & Schumann (MHNG); MA–070, Moyen Atlas, Jbel Tazzeka, Südseite, ca. 1800 mH, 15.V.1995, leg. Aßmuth, Sanetra & Schulz (MHNG); MA–006, Haut Atlas, Tizi-n-Tarlhemt, 55 Rkm SE Midelt, ca. 1800 mH, 27.IV.1995, leg. Güsten, Sanetra & Schumann (MHNG).

Spain: Montnegre, Barcelona, 11.VII.2000, leg. Espadaler (HNHM).

Turkey: Antalya 5 km E Seklient, 35 W Antalya, 1500 mH, pine forest and grassland, 28.V.1993, leg. Schulz (MHNG).

Tetramorium ferox:

Austria: 10346 AUT: Spitzerberg vic. Prellenkirchen (16° 57'E / 48° 05'N), 23.VI.2002, leg. B.C. Schlick-Steiner & F.M. Steiner (HNMH).

Hungary: Sóshartyán, 12.V.2002, leg. Csősz (HNHM); Szigetszentmihály, 1914, leg. Szabó (HNHM).

Ukraine: Krim, S. Simferopol, ca. 300 mH, 13. VIII.1995, leg. Sanetra (MHNG).

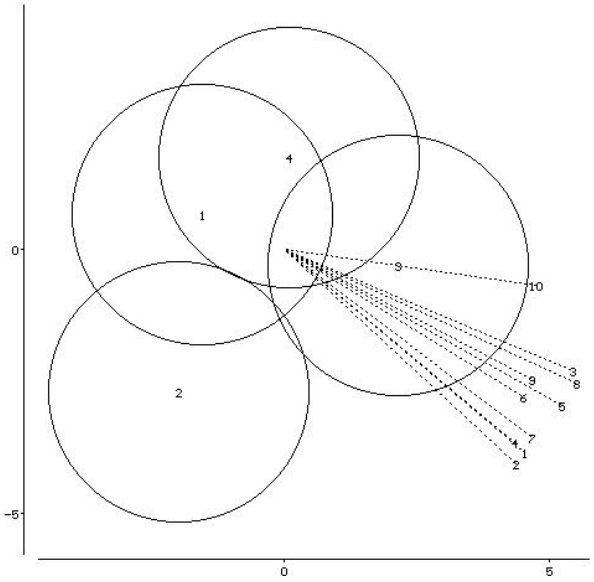


Fig. 1: Discriminant analysis of the four *Tetramorium* morphospecies: biplot of 95 % isodensity circles and variables, with a scale factor of 6.28 for variables along the first two canonical variates. Species: (1) *T. hungaricum*, (2) *T. semilaeve*, (3) *T. caespitum*, (4) *T. ferox*. Variables: (1) HL, (2) HW, (3) FR, (4) SL, (5) ML, (6) MW, (7) Pw, (8) PPw, (9) SSP, (10) SPL. Eigenvalues as % for the first two axes: 64.37 and 27.73 respectively; canonical correlation is 0.87 and 0.76 for the first and the second canonical variate, respectively.

Tetramorium hungaricum RÖSZLER, 1935 (Figs. 2-6)

Tetramorium caespitum ssp. *hungarica* RÖSZLER, 1935: 78 (original description based on worker and gyne castes).

Tetramorium semilaeve var. *hungarica*: KRATOCHVIL, 1941: 86.

Tetramorium hungaricum: RÖSZLER, 1951: 88.

Tetramorium caespitum ssp. *pyrenaeica* var. *biroi* RÖSZLER, 1937: 199 [name not available]; syntype series: 4 workers, 2 males: Hongrie, Nagytétény No. 44, 1.VII. 1935, leg. Röszler (NVH, examined).

Tetramorium caespitum ssp. *hungarica* var. *rufitarsis* RÖSZLER, 1936: 58 [name not available]; syntype series: 3 workers: Hongrie, Nagytétény No. 499, 19.V.1935, leg. Röszler; 1 queen, 1 male: Hongrie, Nagytétény, 27.VI.1935, leg. Röszler (NVH, examined).

Tetramorium caespitum ssp. *hungarica* var. *szaboi* RÖSZLER, 1936: 59 [name not available]; syntype series: 2 workers: Hungaria, Nagytétény No.503, 1.VIII.1934. leg. Röszler (NVH, examined).

Tetramorium caespitum ssp. *hungarica* var. *haltrichi* RÖSZLER, 1936: 61 [name not available]; designated types were not found.

Tetramorium caespitum ssp. hungarica var. rufitarsis-szaboi RÖSZLER [nomen nudum]; Nagytétény, 29.VI.1935, leg. Röszler No. 16 (NVH, examined).

Tab. 1: F values and correlation coefficients of the morphometrical parameters with the first two canonical variates as a result of the discriminant analysis for the four *Tetramorium* morpho-species.

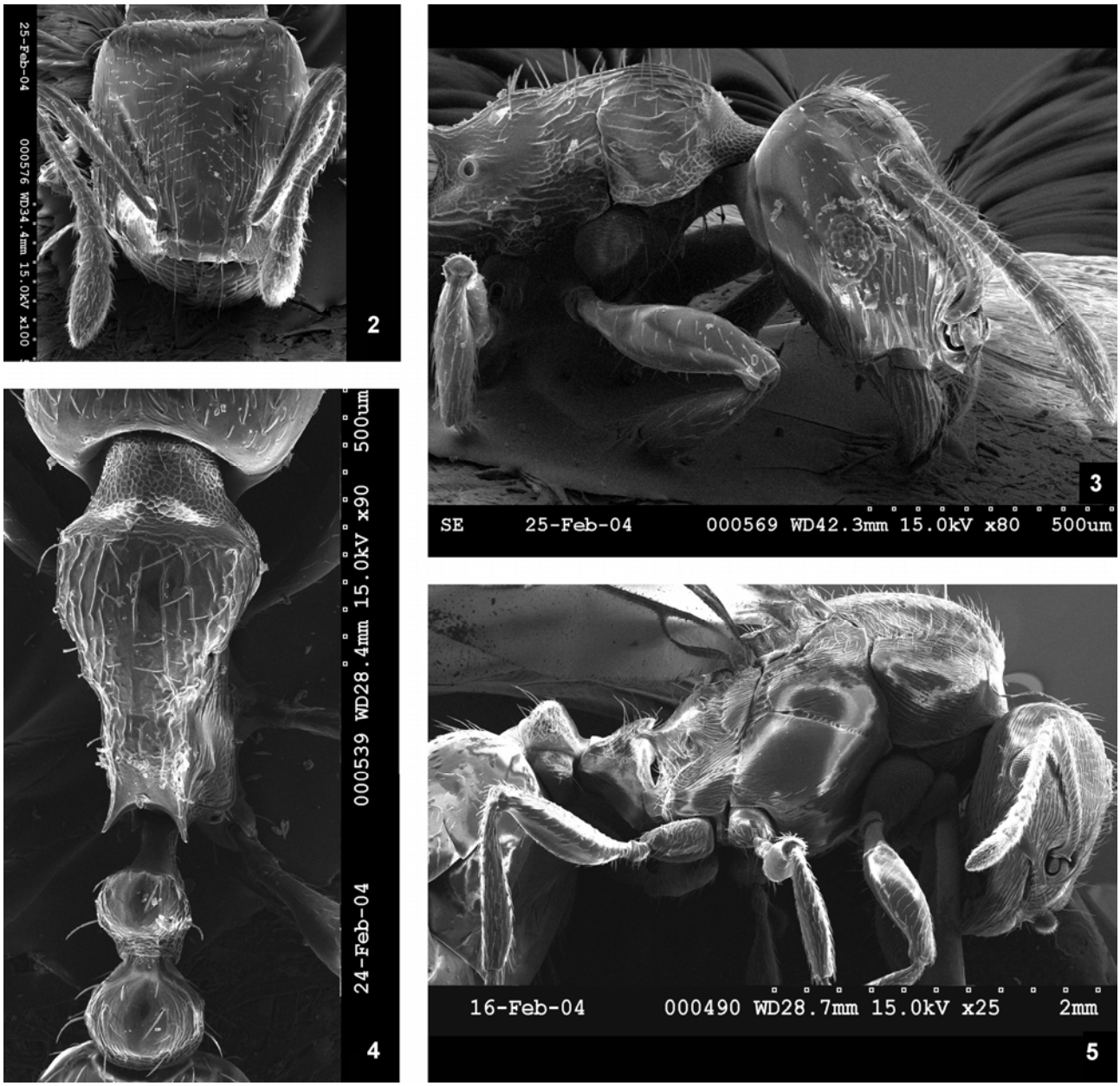
Variable	F	correlation coefficients	
		1st variate	2nd variate
HL	125.75	0.72	-0.61
HW	126.83	0.69	-0.64
FR	148.9	0.86	-0.36
SL	100.6	0.69	-0.58
ML	152.33	0.83	-0.47
MW	81.17	0.72	-0.44
Pw	124.3	0.74	-0.56
PPw	173	0.88	-0.4
SSP	87.86	0.74	-0.39
SPL	70.73	0.75	-0.1

Tab. 2: Comparison of main morphometrical indexes in *T. hungaricum – T. semilaeve* and *T. hungaricum – T. caespitum* species pairs (independent t-test). *P < 0.05, **P < 0.01, ***P = 0.000.

Indexes	*T. hungaricum* vs. *T. semilaeve*	*T. hungaricum* vs. *T. caespitum*
	t	
	df = 119	df = 183
HL/HW	5.16***	3.21**
HS	-14.43***	-19.81***
HW/FR	-10.45***	9.76***
HS/FR	-9.73***	11.32***
HS/SL	0.56	2.4*
ML/MW	-2.12*	-11.08***
HS/ML	-3.19**	16.49***
Pw/PPw	-6.29***	7.03***
SPI	-0.34	1.91
PPI	6.05***	-14.27***

Excluded taxa (not belonging to any of the four species considered here):

Tetramorium caespitum ssp. *hungarica* var. *striatis* RÖSZLER, 1936: 58 [name not available] = *T. impurum*/*caespitum*; syntype series: 2 workers Hungaria, Nagytétény No. 501. leg. Röszler (NVH, examined).



Figs. 2 - 5: *Tetramorium hungaricum*, (2 - 4: worker; 5: gyne): (2) head seen in full face view; (3) head seen in profile; (4) mesosoma, petiole and postpetiole from above; (5) mesosoma in lateral view.

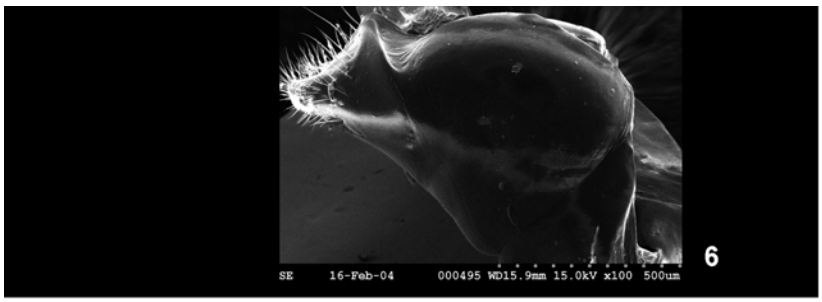
Tetramorium staerckei KRATOCHVIL, 1944: 65 [first available use of *Tetramorium caespitum* ssp. *hungarica* var. *staerckei* RÖSZLER, 1936: 60 = *T. impurum* [KUTTER 1977]; syntype series 2 workers, 2 queen, 1 male: Hongrie, Nagytétény No. 500, 17.VI.1935, leg. Röszler (NVH, examined).

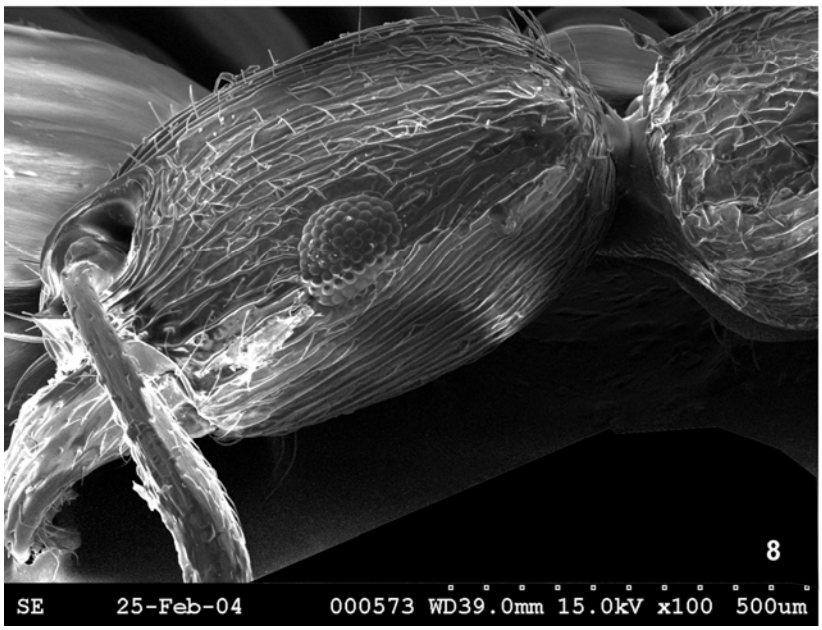
Designation of lectotype

Two syntype workers on the same pin labeled by Röszler as: "Hongrie, Nagytétény No. 465, 24.07. 1934, leg. Röszler (Typus)" deposited in the Natural History Museum of Sibiu (Romania). On the recent designation the upper worker is assigned as lectotype, the worker specimen beneath is assigned as paralectotype. The lectotype is very intact, all parts of the body as well as the differentiation characters are well visible. Altogether twelve other workers from the same locality and same date labelled as "Hongrie, Nagytétény, 24.07.1934, leg. Röszler", but without nest series number are also assigned as paralectotypes: six paralecotype workers are deposited in the HNHM, Budapest and six other paralecotype workers are deposited in the NHM, Wien.

Redescription

Worker: Body length 2.5 - 3 mm. Smaller in size than *T. caespitum* (see Tab. 3). Colour infuscate light to dark brown (never yellow) and in every case the whole body uniformly coloured. Head: sculpture on the entire head dorsum very fine, frons with few fine





Figs. 6 - 8: (6) *Tetramorium hungaricum*, male genitalia in lateral view; (7) *T. caespitum* worker, mesosoma, petiole and postpetiole from above; (8) *T. caespitum* worker, head seen in profile.

longitudinal striae (Fig. 2). Frontal carinae straight and run nearly parallel. In profile between the occiput and the posterior eye level the surface always smooth and shining (Fig. 3). Sometimes the whole head, including the occiput and frons smooth and shining. Mesosoma very similar in shape to that of *T. caespitum*, sculpture much finer with the sides of propodeum often smooth and shining. Propodeal denticles fitted closer to the dorsum of propodeum than to the metapleural lobe seen in profile. Median part of the dorsal surfaces of petiole and postpetiole smooth and shining (Fig. 4). First gaster tergite bears sparse, fragmented microsculpture only.

Gyne: Body length 6.4 mm. Colour dark brown to black. Head: entire head dorsum with dense longitudinal rugae, the sides of head entirely sculpured. Frontal carinae straight and run parallel. Mesosoma very similar in shape to that of *T. caespitum*, its sculpture somewhat finer, mesonotum and scutellum usually smooth and shining, or only with a few longitudinal striae. Katepisternum at least in part smooth and shining (Fig. 5).

Male: Body length 5.5 mm. Colour dark brown to black. Head: frons longitudinally striated, the rest of head with reticulate sculpture. Transverse furrow on the frons below the central ocellus always missing. Mandibles with 5 teeth on the masticatory border. Mesosoma very similar in shape to that of *T. caespitum*. The scutum smooth and shining, striated only along the parapsidal furrow. Scutellum with a few fine longitudinal striae. Masticatory border of mandibles usually bears 5 teeth. For genitalia see Fig. 6.

Biology and distribution

Tetramorium hungaricum seems to be a xerothermophilous species according to the localities, nests are frequent on dry, south-exposed limestone or dolomitic slopes as well as on sandy grasslands. It nests under stones. Colonies contain usually few to several matured queens, in extreme cases queen number may reach up to a few hundreds. Nest aggregations were observed in the population in Mts. Csiki, Budapest, which suggested the possible existence of supercolonial life style. *Tetramorium hungaricum* occurs syntopically with its related species *T. caespitum* on all the studied Hungarian sites. Nuptial flights take place from May till June.

The distribution of this species is hardly known. According to available data on its distribution this species seems to be a Ponto-Caspian, or Balcanian ele-

Tab. 3: Morphometrical data of workers of the four *Tetramorium* morpho-species: mean of absolute values in µm (± SD).

		HL	HW	FR	SL	ML	MW	Pw	PPw	SSP	SPL
hungaricum	mean	648.02	625.30	237.63	480.52	700.77	405.10	194.22	242.33	118.01	78.44
n = 92	SD	26.67	28.48	13.74	37.91	35.35	23.31	13.11	14.46	9.64	8.97
	min	580	555	205	420	620	350	165	210	95	60
	max	710	700	285	530	805	460	240	290	150	100
semilaeve	mean	738.39	728.39	257.14	555.00	792.50	451.07	222.68	265.18	126.25	83.04
n = 28	SD	38.37	46.95	14.75	29.28	41.29	27.43	13.44	18.33	8.35	8.64
	min	670	650	230	505	710	400	195	230	105	70
	max	810	810	290	600	870	510	245	310	140	100
caespitum	mean	777.99	757.50	301.69	595.27	906.09	496.58	246.14	317.99	148.21	100.71
n = 92	SD	58.57	57.94	25.07	53.40	79.76	42.61	23.77	26.28	17.04	11.612
	min	650	630	255	325	770	415	205	265	105	75
	max	930	900	360	705	1100	600	315	395	195	130
ferox	mean	665.60	648.20	252.60	491.00	747.80	429.00	196.80	254.20	116.72	94.20
n = 25	SD	73.49	72.83	32.76	63.25	118.58	91.22	27.46	39.84	16.08	13.20
	min	560	540	210	385	580	325	160	210	90	60
	max	780	745	300	575	910	780	240	320	140	115

ment of European ant fauna. Eleven *Tetramorium hungaricum* populations are known in Hungary and eight in Austria (near the Hungarian border), and two other sites were reported by RÖSZLER (1943) from Ungheni and Târgu Mureş in the central part of Transsylvania (Romania), furthermore this species is very abundant in Ukraine. The easternmost known locality is Donetsk Reg., riv. Severskiy Donets, vil. Bogorodichnoe (38º E), while its westernmost known locality is the western borderline of the Carpathian Basin.

Known co-occurrences with other ant species are as follows: *Bothriomyrmex menozzii* EMERY, 1925, *Camponotus aethiops* (LATREILLE, 1798), *C. atricolor* (NYLANDER, 1849), *C. piceus* (LEACH, 1825), *C. vagus* (SCOPOLI, 1763), *Cataglyphis aenescens* (NYLANDER, 1849), *C. nodus* (BRULLÉ, 1832), *Formica fusca* LINNAEUS, 1758, *F. pratensis* RETZIUS, 1783, *Lasius alienus* (FÖRSTER, 1850), *L. psammophilus* SEIFERT, 1992, *Leptothorax gredleri* MAYR, 1855, *Messor muticus* (NYLANDER, 1849), *M. structor* (LATREILLE, 1798), *Plagiolepis pygmaea* (LATREILLE, 1798), *Solenopsis fugax* (LATREILLE, 1798), *Tapinoma ambiguum* EMERY, 1925, *T. erraticum* (LATREILLE, 1798), *Temnothorax crassispinus* (KARAWAJEW, 1926), *T. parvulus* (SCHENCK, 1852), *Tetramorium caespitum* (LINNAEUS, 1758).

Differential diagnosis

The discriminant analysis yielded a powerful differentiation among species (Wilk's lambda 0.07 and 0.29 for the first and the second canonical variate respectively) (Fig. 1). *T. caespitum* was separated mostly by the first canonical variate, and *T. semilaeve* by the second canonical variate, whereas *T. ferox* was the least separated from *T. hungaricum*. Upon the basis of the correlation coefficients (Tab. 1) PPw, FR and ML were the best discriminators along the first and HL and HW along the second canonical variate.

T. hungaricum populations

Although the Wilk's lambda values were significant for the first two axes – 0.23 ($\chi^2 = 118.58$, $p < 0.01$, df = 60, can. corr. 0.66) and 0.42 ($\chi^2 = 69.63$, $p < 0.05$, df = 45, can corr. 0.54), respectively – the statistical analysis did not yield clear-cut results regarding the separation of *T. hungaricum* populations (cumulative values of the percentage of eigenvalues for the first two axes: 68.93 %). Thus comparison of the different morphometrical parameters did not show any significant differences among the populations with the exception of the SSP values (ANOVA, $F = 2.51$, $df_1 = 6$, $df_2 = 85$, $p = 0.028$). This parameter showed

Tab. 4: Morphometrical data of workers of the four *Tetramorium* morpho-species: mean value of indexes (± SD).

		HL/HW	HS	HW/FR	HS/FR	HS/SL	ML/MW	HS/ML	Pw/PPw	SPI	PPI
hungaricum	mean	1.04	636.66	2.64	2.68	1.34	1.73	0.91	0.80	1.52	0.39
n = 92	SD	0.02	26.94	0.08	0.08	0.07	0.06	0.02	0.03	0.17	0.02
	min	0.99	567.50	2.45	2.47	1.26	1.58	0.85	0.75	1.19	0.35
	max	1.09	705.00	2.89	2.93	1.45	1.96	0.98	0.86	2.17	0.43
semilaeve	mean	1.02	733.39	2.83	2.85	1.32	1.76	0.93	0.84	1.53	0.37
n = 28	SD	0.02	42.31	0.11	0.09	0.04	0.04	0.02	0.04	0.14	0.02
	min	0.99	660.00	2.58	2.64	1.28	1.69	0.88	0.74	1.30	0.33
	max	1.05	810.00	3.10	3.09	1.50	1.84	0.99	0.92	1.79	0.42
caespitum	mean	1.03	767.75	2.51	2.55	1.30	1.83	0.85	0.77	1.48	0.42
n = 92	SD	0.02	57.77	0.09	0.08	0.12	0.05	0.03	0.03	0.12	0.02
	min	0.98	640.00	2.22	2.23	1.22	1.64	0.78	0.72	1.19	0.39
	max	1.12	915.00	2.76	2.78	2.37	1.98	0.91	0.94	1.84	0.46
ferox	mean	1.03	656.90	2.57	2.61	1.34	1.76	0.89	0.78	1.25	0.39
n = 25	SD	0.01	73.06	0.07	0.08	0.03	0.14	0.04	0.03	0.17	0.02
	min	1.00	550.00	2.43	2.47	1.30	1.15	0.82	0.71	1.02	0.36
	max	1.05	762.50	2.73	2.77	1.43	1.89	0.95	0.83	1.59	0.44

the highest correlation coefficient with the first canonical variate: -0.46. On this basis *T. hungaricum* populations can be considered as insignificantly heterogeneous in morphometrical features.

T. hungaricum vs. *T. caespitum* morphospecies

Workers of *T. hungaricum* and *T. caespitum* are quite easy to distinguish from each other based on differences in sculpture. In *T. caespitum* entire head, including the lateral surface between the occiput and the posterior eye level is always striated (Fig. 8), while the dorsum of head in *T. hungaricum* is more or less smooth, or with very fine, longitudinal striae only. In lateral view the surface between the occiput and the posterior eye level is always smooth and shining (Fig. 3). Gynes and males of both species have similar diagnostic morphological characters. In the case of *T. hungaricum* gyne the katepisternum is smooth and shining at least in part (Fig. 5), while in *T. caespitum* the entire surface of katepisternum is covered always with dense, logitudinal striae. The male genitalia do not bear any reliable diagnostic characters. Separation of males of both species is feasible on the bases of number of teeth on the mandibular masticatory border. Petiole, postpetiole and stipes of *T. hungaricum* male are very similar to that of *T. caespitum*, without reliable diagnostic characters. Mandibles of the male of *T. hungaricum* bear 4 - 6 (mean 5.1, n = 11) teeth while those of the male of *T. caespitum* bear 4 - 7 (mean 5.95, n = 13) teeth.

The discriminant analysis separated efficiently workers of *T. hungaricum* from *T. caespitum* (Fig. 9). The best discriminators were PPw (0.96), ML (0.94), FR (0.93), HL (0.9) and HW (0.9) on the basis of the correlation coefficients, nevertheless, all the other parameters had coefficients higher than 0.75. The pairwise morphometrical comparison also resulted in significant differences between these species regarding most of the indexes (Tab. 2). The differences between the means (Tab. 4) showed that PPI could be used safely to separate these two species.

T. hungaricum vs. *T. semilaeve* morphospecies

Workers of *T. hungaricum* are easy to confuse with that of *T. semilaeve* based on sculpture. Entire head of workers of both species, including the lateral surface between the occiput and the posterior eye level, is more or less smooth, or with very fine longitudinal striae only. Metric characters and indexes give perfect discrimination between the two species. Frons of *T. semilaeve* workers is very narrow (HW / FR: 2.83), while in the case of *T. hungaricum* workers the frons is wider (HW / FR: 2.63). The head of *T. hungaricum* workers is slightly longer than broad (HI: 1.04), while in the examined eastern populations (Senj/Croatia, Varna/Bulgaria, Kykladen, Paros/Greece, Antalya/

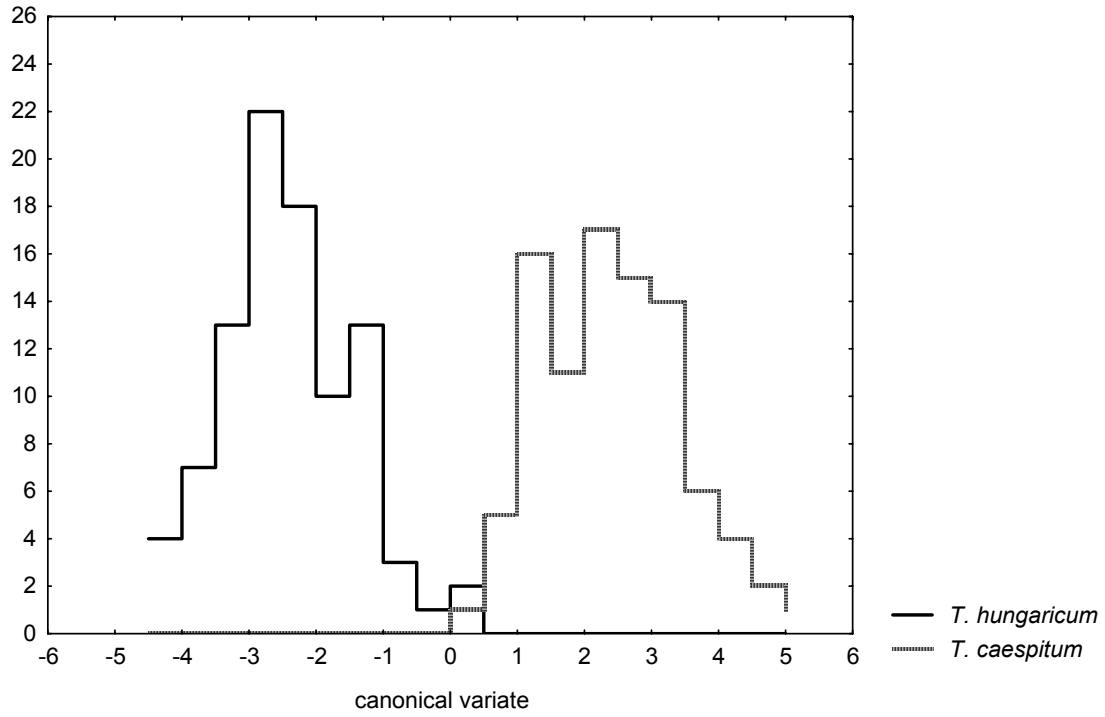


Fig. 9: Distribution of specimens of *T. hungaricum* and *T. caespitum* morphospecies along the canonical variate of the discriminant analysis (Wilk's lambda = 0.15, χ^2 = 339.94, p < 0.000, df = 10; canonical correlation coefficient = 0.92; $n_{hungaricum}$ = 93, $n_{caespitum}$ = 92).

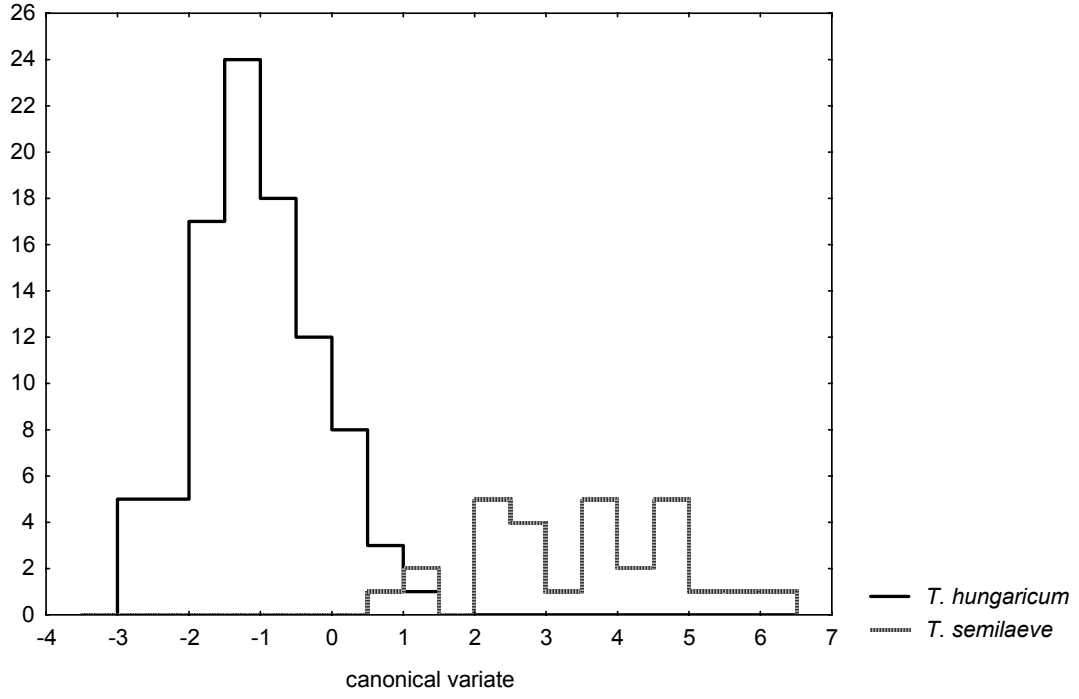


Fig. 10: Distribution of specimens of *T. hungaricum* and *T. semilaeve* morphospecies along the canonical variate of the discriminant analysis (Wilk's lambda = 0.21, χ^2 = 173.17, p = 0.000, df = 10; canonical correlation coefficient = 0.88; $n_{hungaricum}$ = 93, $n_{semilaeve}$ = 28).

Turkey) of *T. semilaeve* the head is quadratic, as long as broad (HI: 0.99). It needs to be mentioned, that in the western *T. semilaeve* populations (Banyuls sur Mer/France, Montnegre, Barcelona/Spain), however, the head is clearly longer (HI: 1.03).

There are no difficulties in distinguishing the *T. hungaricum* and *T. semilaeve* sexuals. The mesosoma of the gyne of *T. semilaeve* is very low and flat seen in profile, and the pronotal angles are strongly visible from above. The gyne of *T. hungaricum* is larger in size, its mesosoma is higher and the pronotal angles are not visible. In the males of the two species the genitalia give a clear separation. *T. hungaricum* and *T. semilaeve* workers were also clearly separated by the discriminant analysis (Fig. 10). The best discriminators were HW (0.89), HL (0.88), ML (0.81), and SL (0.78) on the basis of the correlation coefficients. All the other parameters had coefficients lower than 0.75. The pairwise morphometrical comparison yielded significant differences between *T. hungaricum* and *T. semilaeve* (Tab. 2) with the exception of HS / SL ratio and the SPI. On the basis of the distance between the means (Tab. 4) HW / FR, Pw / PPw and PPI measures seemed to be the best morphometric characters to separate these two species.

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Zusammenfassung

Tetramorium hungaricum RÖSZLER, 1935 ist ein mitteleuropäisches Taxon, welches hier redeskribiert wird; ein Lectotypus wird festgelegt. Es wird gezeigt, dass diese Art von den drei verwandten Morphospezies, *T. caespitum* (LINNAEUS, 1758), *T. ferox* RUZSKY, 1903 und *T. semilaeve* ANDRÉ, 1881, verlässlich mittels morphologischer Merkmale unterschieden werden kann. Diagnostische Merkmale, sowohl morphologische als auch morphometrische, werden für die vier Arten angeführt.

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